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vol.7 no.1 a newsletter for ocean technologists

The NORDA Vertical Profiler

INTRODUCTION

The vertical profiler, being developed by the Naval Ocean Research and Development Activity (NORDA) under sponsorship of the Ocean Programs Office, is a controlled buoyancy package which carries a modularly constructed data-collection payload. The profiler is normally tethered with a buoyant line from a taut-moored, subsurface float, as shown in Figure 1, and deployment is by the anchor-last technique. In this mooring configuration, the profiler can traverse from the air/sea interface to the maximum design depth (1000 m for the present experimental unit). In applications where horizontal motions of the profiler might be objectionable, the device can traverse a taut wire with a subsurface float close to the surface. In this alternate arrangement, the profiler motions are constrained to the vertical but its capability to profile all the way to the air/sea interface is lost.

SYSTEM DESIGN DESCRIPTION

The profiling system consists of a variable buoyancy vehicle which contains the ballasting and data collection subsystems and the mooring system which holds it in place. The ballasting subsystem controls the buoyancy of the profiler vehicle by pumping oil, on command, from an internal sump into an external bladder or by allowing sea pressure to force the oil from the external bladder into the internal sump. The transfer of oil is controlled by a programmable timer within the instrumentation sphere and can be set for various dive and ascent times. Ascent and descent rates are not controlled in the present unit but the somewhat complex circuits necessary for these functions could be added. Present travel rates for low-current conditions average about 0.5 m/s of vertical motion.

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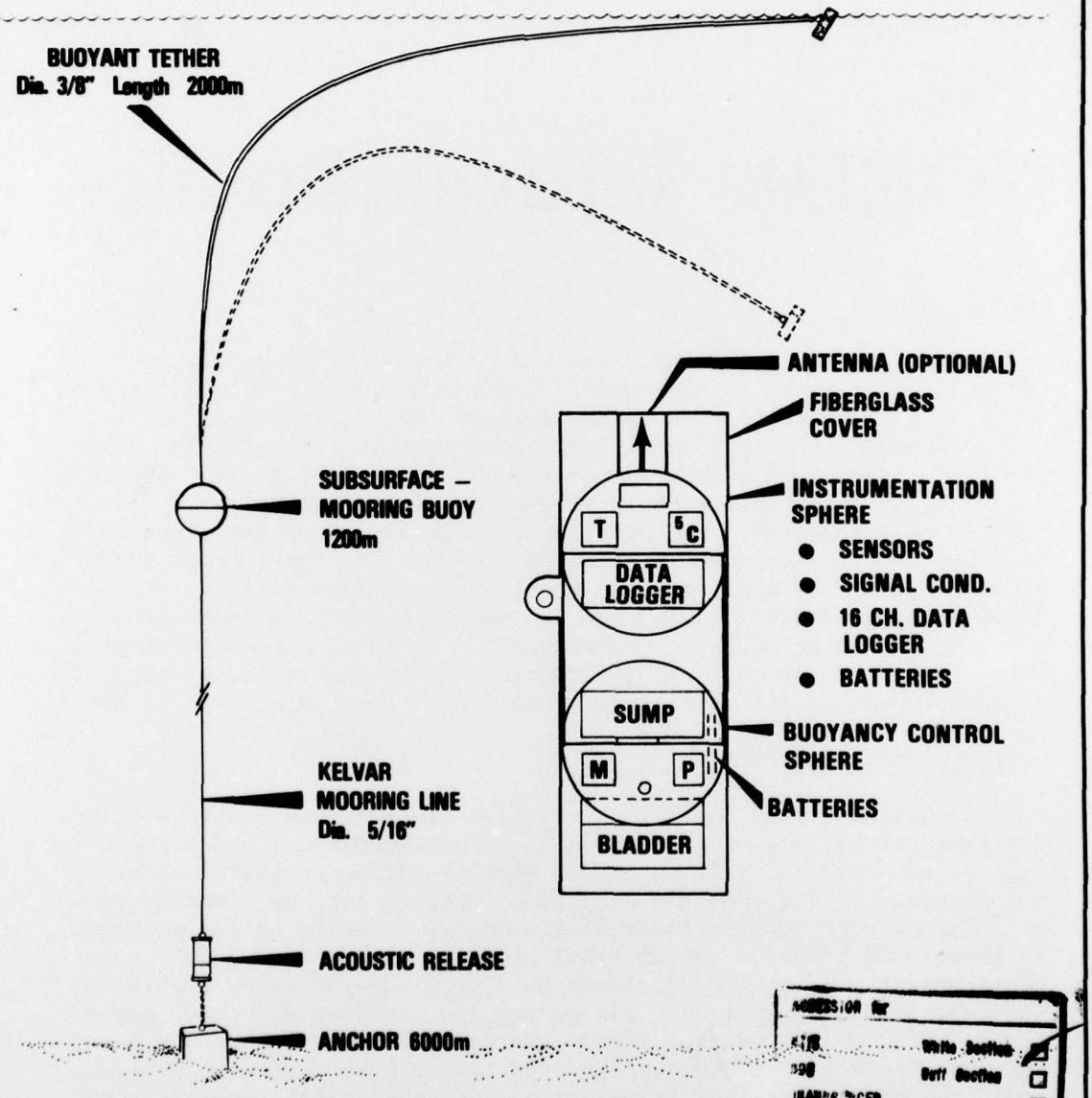
FIGURE 1

NORDA
VERTICAL PROFILER



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The data-collection system consists of parameter sensors interfaced to a 16-channel digitizing and recording system. The sensors and interfaces can be selected in such a manner that the profiler can be configured for a specific measurement program. The present experimental unit is configured for temperature, pressure, and heading information. It is planned to add conductivity in the near future so that profile measurements of density as well as temperature can be accomplished. Sensors can be added or deleted as necessary to optimize the package for a specific experiment. Data are stored in digital form on cassette tape. Approximately 120,000 data values can be stored before the tape is filled. All recorded data is time-tagged by entering the clock time of the buoyancy control timer each time a file of data is recorded. In the present experimental unit, all data is stored internally but it could be telemetered via satellite rather easily with the addition of an appropriate antenna and R. F. transmitter.

The mooring configuration shown in Figure 1 is for the case where profiling to the air/sea interface or radio communications to a remote receiving site is required. The subsurface mooring buoy provides a "false bottom" for tethering of the variable buoyancy package. This buoy is connected via a low-stretch, high-strength Kevlar line to the deadweight anchor which holds the entire assemblage in position. An acoustic release enables recovery of all system components except the anchor. The depth of the subsurface buoy is not critical so long as sufficient tether line exists for the profiling unit to reach the surface. The depth of the subsurface buoy and the tether line length can be varied to suit the actual profiling depth desired.

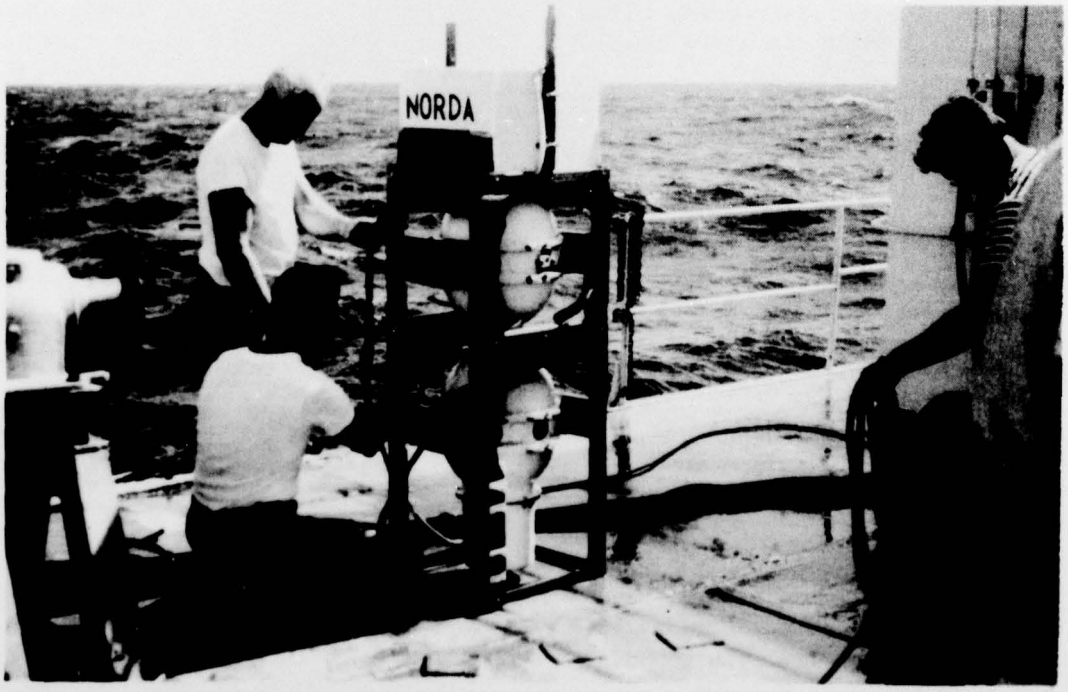

FIGURE 2 *Present NORDA Experimental Vertical Profiler*

The full-length tether line permits profiling in the present experimental unit to 1000 m and provides sufficient buoyancy to just balance the profiling package when it is suspended on 1000 m of tether line. Profiling to more shallow depths can be easily accomplished by shortening the tether line and placing a small float or floats on the tether line at a distance from the profiling package equal to the desired profiling depth.

The present experimental unit (Figure 2) is powered by a 20-ampere-hour lithium battery pack which is capable of powering approximately 25 round trips to a depth of 1000 meters. As the profiling depth is decreased, more round trips can be made because less energy is required to pump the oil at shallower depths. The energy versus depth ratio for buoyancy control is rather linear so that 50 trips to 500 m or 100 trips to 250 m, etc., are possible. Figure 2 shows the experimental unit being given a final check prior to a sea test.

SYSTEM APPLICATIONS

The system configuration illustrated in Figure 1 can be used to satisfy two important requirements. The first is measurement of ocean parameter profiles over some predetermined length of water column, including the surface. The second is transmission of data collected from fixed sensors on the bottom or beneath the subsurface buoy via telemetry (such as satellite) to a remote receiving location.

Ocean profiling can easily be accomplished for temperature, conductivity, and pressure, from which one can infer thermal and density structures. The present experimental unit will have conductivity measuring capability added in calendar year 1979.

When the profiler is used as a submersible telemetry transmitter, data from a number of fixed sensors can be collected and transmitted. The principal advantage in using this type profiler as a submersible telemetry transmitter is that the equipment remains below the sea surface except during short transmission periods. Thus, the telemetry system could minimize the risks associated with typical surface buoy telemetry.

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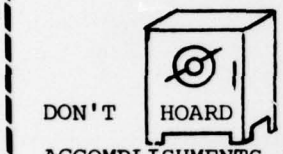

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